

REMARKS

Reconsideration of this application is requested in view of the amendments to the claims and the remarks presented herein.

The claims in the application are claims 1 to 3, 5 to 10, 12 to 14 and 16, all other claims having been cancelled.

Claim 1 and the claims dependent thereon, were rejected under 353 USC 112, second paragraph as being indefinite since the Examiner deemed claims 1 and 8 to be confusing with the expression “at least one palladium compound” and the term “which comprises”.

Applicants respectfully traverse these grounds of rejection since the claims have been amended to clarify the same. Claims 1 and 8 now call for the catalyst as being provided by loading the porous support with at least one palladium compound and then has been indicated as to the support comprising a reducible metal oxide as recited therein. Therefore, it is believed that the claims are now clear and withdrawal of this ground of rejection is requested.

Claims 1 to 4, 6 to 11, 13, 14 and 16 were rejected under 35 USC 102 as being rejected under 35 USC 102 as being anticipated by the Couves et al reference and claims 5 and 12 were rejected as being obvious thereover. The Examiner states that the reference teaches a catalyst made by impregnating a palladium compound onto a support which may be porous titania reducing at elevated temperatures of 100 to 500°C until the material is reduced and then applying an alkali metal compound which is taught as being done in any suitable stage preparation. With respect to claims 5 and 12, the Examiner concedes that the reference does not specifically teach a duration of the reduction but teaches that the reduction takes place until the material is reduced and therefore, they are obvious therefrom.

Applicants respectfully traverse this ground of rejection since it is deemed that the Couves et al reference does not anticipate or render obvious the present invention which is directed to the production of vinyl acetate by contacting ethylene, acetic acid and an oxygen containing gas with a palladium catalyst prepared by impregnating a catalyst support with a palladium compound, converting the palladium compound to substantially metallic palladium and then sintering the supported palladium at a temperature greater than 500°C.

The Couves et al reference discloses a process for the production of vinyl acetate in the presence of a catalyst prepared according to Example 1 in columns 5 and 6 by

impregnation of the support with palladium and gold compounds, precipitation of the palladium and gold compounds on the support, reduction of the palladium and gold compounds to the metallic state, washing of the supported compounds, sintering of the loaded support and then impregnation with metal acetate. According to lines 45 to 47 of column 4, the reduction step is conducted at temperatures of 100 to 500°C if carried out in the gaseous phase.

What? ^{Ques 2} It is an important feature of the Couves et al process that the supported palladium is sintered at temperatures above 500°C as taught in lines 12 and 13 of column 2. In lines 5 to 14 of column 2, the sintering step is conducted in a temperature range preferably of 650 to 1,000°C in the presence of a reducing gas but an oxidizing gas or an inert gas can be used during the sintering step as well. According to columns 1 and 2 of the reference, the sintering step decreases the initial activity of the catalyst and enhances the lifetime of the catalyst as taught in lines 14 to 16 of column 7.

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Moreover, if the catalyst is sintered before use in the vinyl acetate production, then an excess of potassium acetate can be used as taught in Table 2 of column 8. In addition, line 67 of column 1 through line 1 of column 2 discloses that the sintering step increases the average pore size of silica supports and the working examples use a KA160 silica support (lines 36 and 37 of column 5). After loading the support with the catalytically active metals, the support is sintered at 800°C for eleven hours as taught in

lines 63 to 65 of column 2 of the reference, titania can be used as a support in the process.

The Examiner deems the present invention to be anticipated by the reference which discloses the use of titania as support material and a reduction step in the temperature range of 100 to 500°C. However, in view of the Couves et al reference, it is believed that the present claims, which are directed to the use of a catalyst with a porous support referring to titanium dioxide obtained by flame hydrolysis of titanium tetrachloride, distinguishes therefrom. The new claims are supported by the working examples wherein the titanium dioxide support of Degussa P25 pellets are used. These pellets are known by the prior art to be produced by flame hydrolysis of titanium tetrachloride and titanium prepared according to such a procedure is also referred to as fumed titania. Applicants are submitting herewith a copy of Catalysis Today. Vol. 14, 1992, pages 225 to 242 which confirms this. The present claims also recite a temperature range of 300 to 500°C for the reduction step which is supported by the working examples wherein a reduction temperature of 500°C was used.

The amended claims call for a catalyst supported on a titanium dioxide support produced by flame hydrolysis of $TiCl_4$ obtained by conducting the reduction in the range of 300 to 500°C. The temperature treatment of such titanium dioxide support has an important influence on the structure of the titanium support as taught on pages 236 to 238 of the submitted reference. At temperatures below 500°C, only minor changes take place

in the crystal structure. However, if the titania support obtained from flame hydrolysis is heated above 500°C, then the change in the crystal structure from the anatas-type into the rutile-type occurs which is accompanied by a decrease in the surface area as taught on page 237 of the reference, Figure 8. However, if the titania support is based on precipitated TiO₂, then there is no change in the crystal structure from the anatas to the rutile-type up to 900°C as taught in the third paragraph of page 238. This means that the claimed catalyst is based on the anatas-type titania because it is produced by a flame hydrolysis of titanium tetrachloride with a reduction temperature of up to 500°C.

In contrast thereto, the Couves et al reference refers to a catalyst sintered at a temperature of greater than 500°C as can be seen from claim 1 of the reference and preferably at a temperature of 650 ° to 1,000°C as set forth in claim 7. Moreover, the reference is silent about any specific type of titania suitable for the process disclosed therein. Therefore, even if the titania support mentioned in the reference was based upon titania produced by flame hydrolysis of titanium tetrachloride, the supported catalyst would have a rutile-type titania support having a lower surface area than Applicants' catalyst which is based on the anatas-type titania having a higher surface area.

Therefore, Applicants' catalyst is distinct from the catalyst of Couves et al because it is based on fume titania having an anatas-type titania support whereas the catalyst of the reference is based on a rutile-type titania support. Therefore, the reference does not anticipate Applicants' invention and withdrawal of this ground of rejection is requested.

It is known to those skilled in the art that a high surface area support gives a better catalysts performance due to the better access of the gaseous components to be reacted to the active slots of catalysts. Therefore, a catalyst based on fume titania and prepared according to the sintering process of Couves et al would have a low surface area and would have a decreased performance in a catalytic reaction. The reference discloses a titania support generally and does not distinguish between fumed and precipitated titania nor does it mention the influence of the sintering temperature on the crystal structure and the corresponding surface area. The titania support of the reference is only mentioned in lines 643 to 65 of column 2 as having an average pore size of silica supports that will increase due to the sintering but it is completely silent about the influence of the sintering step on the titania support. The reference would lead one skilled in art away from Applicants' invention wherein the temperature treatment is restricted to a maximum of 500°C to avoid the change in crystal structure from the high surface anatas-type titania to

the low surface rutile-type titania. The reference merely teaches sintering above 500°C, preferably 650° to 1,000°C which leads inevitably to the low surface are rutile-type titania. One skilled in the art would have no motivation to restrict the temperature treatment to not more than 500°C since the reference teaches directly away from this.

To demonstrate the differences between the claimed catalyst and that of the Couves et al reference, Applicants are submitting herewith an unexecuted declaration for consideration by the Examiner. The executed declaration will be submitted in the near future. However, it is requested that the Examiner consider the results therein. It can be seen from the test data that catalyst A prepared by the present invention is compared with catalyst be prepared by the reference process. The results clearly demonstrate that the sintering treatment of the prior art has a detrimental effect on carbon dioxide formation and the space-time yield and shows the superior performance of the claimed catalyst with respect thereto. The results of comparison Example 1 and comparison Example 5 as disclosed on page 24 of the specification, clearly shows an improvement with regard to the selectivity and space-time yield. Therefore, it is deemed that Applicants have clearly demonstrated the improved results of Applicants' catalyst and withdrawal of this ground of rejection is requested.

In view of the amendments to the claims and the above remarks, it is believed that the claims clearly point out Applicants' patentable contribution and favorable reconsideration of the application is requested.

Respectfully submitted,
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Enclosures